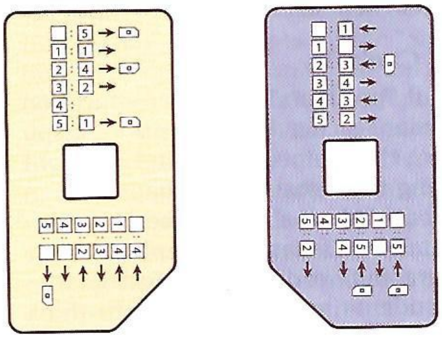
About the cover

Smart Card

This month's cover illustrates a Turing machine discovered by Yuri Rogozhin and implemented by Alvy Ray Smith, the author of the review in this issue of four books about Alan Turing. Rogozhin is responsible for discovering a number of very small universal Turing machines, some time after Marvin Minsky proposed one with 7 states and an alphabet of 4 symbols. The one here has 4 states, corresponding to configurations of the card, with alphabet [0, 5]. The cards on the cover are slightly different from the one illustrated in Smith's review. The commands relevant to a given state are the ones easily readable in that state.



Rogozhin's UTM(4,6) is apparently the smallest UTM so far known.

Smith tells us, "UC Berkeley passed out a copy of the card to each of 8,000 entering freshmen this year, along with a copy of George Dyson's *Turing's Cathedral* and a small pamphlet that could serve as a manual for the card. The computation detailed in the manual and on the *Notices* cover (with initial tape `5155[0]...`) halts, but is otherwise uninteresting. Programming this business card machine to simulate an arbitrary Turing machine—to compute something actually interesting—would be quite difficult. I didn't and won't bother even to try. My goal was simply to show that a universal stored-program computer can be *very* simple. Programming it, on the other hand, is not.

"Programming the little guy goes like this: Implement the algorithm you wish to compute as a Post tag system (known to be equivalent to Turing machines). Encode the tag system as dictated in the Rogozhin paper. That's the program that is then 'stored' on the UTM's tape. The encoding step is quite elaborate (because so few symbols are allotted to the task). Actual programming is just too hard to explain in a page or two."

For help in beginning such a task, Marvin Minsky's classic text *Computation: Finite and Infinite Machines* is still valuable. As a reward for even a few steps in the project, you will certainly acquire an appreciation of the importance of hierarchies of structures.

The manual Smith mentions can be found at `http://alvyray.com/CreativeCommons/BizCardUniversalTuringMachine\_v1.4.pdf`

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and situation. An increasing proportion of today's students, both on campus and online, are "nontraditional" students, usually older and more likely to have schedules constrained by family or work obligations. For these nontraditional students, the asynchronous nature of MOOCs is a major advantage, as is their availability from any location with reliable Internet access. No doubt these students would benefit from in-person discussions on campus, but for most that may not even be an option. The same is true for students of any age living far from the educational institutions that provide the MOOCs they "attend." Perhaps this issue exemplifies the most obvious advantage and disadvantage of MOOCs: while online classes are extremely convenient for students to fit into their schedules and can be accessed remotely, this also means that MOOC students will not be in the same place at the same time as other humans, either fellow students or instructors.

In conclusion, we note again that the focus of this article is the potential for MOOCs in delivering instruction, and especially instruction in math and related fields. We have not tried to address the possible impact of MOOCs on university faculty with respect to their research mission. And finally, we should emphasize that the landscape of MOOCs is changing so rapidly that any published article, including this one, is already out of date in some respects.

References

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